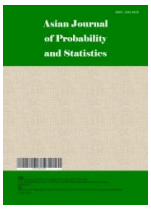

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Factors of the Prevalence of COVID-19 for Females in Amhara Region, Northern Ethiopia

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Author's contribution

Author YA designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. I also managed the analyses of the study and managed the literature searches.

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Abstract

The COVID-19 pandemic in Ethiopia is a global epidemic of coronavirus disease 2019 caused by severe acute respiratory syndrome coronavirus 2. Amhara Region is a regional state in northern Ethiopia and the homeland of the Amhara people. The main objective of this study was to identify factors of the prevalence of COVID-19 for females in Amhara region**.** The data set was obtained from Amhara Public Health Institute 2020. A negative Binomial regression model was conducted to find out the determinants of the prevalence of COVID-19 for females. Out of 5,627 confirmed cases, 96 patients have died and 1,483 confirmed cases were females from 138 daily reports. Number of recovered COVID-19 cases (β = -0.4566332, 95%CI: (-0.7364772, -0.1767892), P-value < 0.05), severe cases (β= 1.038589, 95%CI: (0.7531619, 1.324017), P-value < 0.05), total deaths (β= 0.5164175, 95% CI: (0.1438362, 0.8889987), P-value <0.05) and the average age of patients per day (β = 1.511936, 95% C.I: (0.9220257, 2.101846), P-value < 0.05) were statistically significant factors for the confirmed case of COVID-19 for females in Amhara region. Above 30 average age of patients per day, below 19 number of recovered cases, above 12 number of severe cases, and above two number of deaths are optimally high-risk factors of confirmed cases of COVID-19 for females.

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Keywords: COVID-19; prevalence; female; count regression model; Amhara region.

Abbreviations

COVID-19, Coronavirus Disease 2019.
NB, Negative Binomial
AIC, Akaike Information Criteria
BIC, Bayesian Information Criteria

1 Introduction

COVID-19 is a universal disaster, with speedy dispersion, that has affected death worldwide. It is also a zoonotic communicable disease that can spread from animal to human and from human to human [1]. The main diffusion way of COVID-19 is respiratory droplets produced from an infected person while sneezing and coughing. It is also transmitted by infected surfaces and objects since the virus can survive everywhere [2].

Numerous buzzes revealed that most of the COVID-19 deaths are related to old age. As previous studies suggest, the risk modeled by old age to COVID-19 mortality is explained by the presence of more than one disease (such as hypertension or diabetes magnifies the risk of dying from COVID-19) in a patient in older patients [3].

COVID-19 mortality rates were determined using sex or gender-specific population sizes for each country using 2020 population estimates from the Central Intelligence Agency (CIA) World Factbook [4].

The COVID-19 pandemic in Ethiopia is a global epidemic of coronavirus disease 2019 caused by severe acute respiratory syndrome coronavirus 2. The virus was confirmed to have reached Ethiopia on 13 March 2020 [5].

After multiple cases of the virus were reported, several regions of the country took measures to prevent the further spread of the virus. Travel restrictions and lockdowns were imposed by Amhara regions [6]. On 25 March 2020, the Amhara regional government well-organized civil servants that are at high risk to work from home [7]. On 30 March 2020, it was announced that anyone who returned from abroad in the previous three weeks should report to the local health offices [8]. On 31 March 2020, a 14-day entire lockdown of Bahir Dar and three other towns was imposed [9].

Ethiopia's new confirmed COVID-19 cases were 14,190 in December, taking the total number of confirmed cases to 124,264. The death toll rose to 1,923. The number of recovered patients increased to 112,096, leaving 10,245 active cases at the end of the month [10]. Ethiopia's confirmed COVID-19 cases pass 133,000. The Ethiopian Ministry of Health on January 24, 2021, reported 469 new COVID-19 cases, as the total number of confirmed cases hit 133,767 in the country. COVID-19 positive cases have been reported throughout Ethiopia, with the highest number of cases still being reported in each region. It is to be noted that in the case of Tigray, no reports of COVID-19 related data have been received since 4 November, due to the conflict in the region [11].

Amhara Region is a regional state in northern Ethiopia and the homeland of the Amhara people. Previously known as Region 3, its capital is Bahir Dar. Ethiopia's largest inland body of water, Lake Tana, which is the source of the Blue Nile River, is located within Amhara. Accordingly, as of 30 November, the distribution of cases by the Amhara region was 6,383 cases [11]. Amhara health bureau on January 24, 2021, reported 6 new COVID-19 cases, as the total number of confirmed cases rises to 6,765 in the Amhara region. The main objective of this study was to identify factors of the prevalence of COVID-19 for females in the Amhara region**.**

2 Materials and Methods

2.1 Source of the data

The source of the data for this study was the 2020 Amhara Public Health Institute daily reports. The data accessed from the Amhara Public Health Institute is freely available. The data from the case records were held

with strong accountability and privacy. The study was started after the authorization declaration was obtained from the Injibara University research committee.

2.2 Variables in the study

The response variable for this study was the number of confirmed cases of females in COVID-19 per day. The predictor variables were the average age of patients per day, number of recovered cases per day, number of severe cases per day, and number of deaths in COVID-19 per day. The offset variable was total tests for COVID-19.

2.3 Methods of data analysis

In this study, the variable of interest is a count variable. When the response or dependent variable is a count (which can take on non-negative integer values (0, 1, 2, ...), it is appropriate to use non-linear models based on non-normal distribution to describe the relationship between the response variable and a set of predictor variables. For count data, the standard framework for explaining the relationship between the outcome variable and a set of explanatory variables includes the Poisson and negative binomial regression models.

3 Results

The data set was obtained from Amhara Public Health Institute 2020 and the data released online daily report. Out of 5,627 confirmed cases, 1,483 confirmed cases were females and 4,144 confirmed cases were males from 138 daily reports, and from this 96 patients were died. Table 1 showed the frequency and percentage distribution of the number of female confirmed cases of COVID-19 in the Amhara region based on information from 138 daily reports. While 10.1% of the female never confirmed COVID-19, 9(6.5%), 12(8.7%), 8(5.8%), 13(9.4%), 3(2.2%), 4(2.9%), 4(2.9%) and 71(51.4%) of females confirmed COVID -19 in Amhara region.

Table 1. Frequency of number of female confirmed cases of COVID-19 in Amhara region

Number of female confirmed cases of COVID-19	Frequency	percent
0	14	10.1
1	9	6.5
2	12	8.7
3	8	5.8
4	13	9.4
5	3	2.2
6	4	2.9
7	4	2.9
≥8	71	51.4
Total	138	100.0

The number of the female confirmed case has a rapidly decreasing tail and is highly skewed to right with excess zeros. Among the confirmed cases of the 1,483 females considered in the study. While the minimum value for the number of under-five deaths was 0, the maximum value was 7. The variance of the outcome variable is greater than the mean and the ratio $\frac{109.282}{10.746}$=10.17 > 1 indicating over-dispersion. Both test statistics (Deviance and Pearson Chi-square) indicating over-dispersion (Table 2).

Table 2. The results of the over-dispersion test

Statistics	Value	Degree of freedom	P-value
Deviance	757.3502	130	0.0000
Pearson chi-square	991.7551	130	0.0000

The most appropriate model can be compared by using log-likelihood, AIC, and BIC values.

Table 3. Fit statistic of count regression models

Criteria	Poisson	NB
Log-likelihood	-617.45487	-409.76936
AIC	1244.91	831.5387
BIC	1259.436	848.9704

The model with the minimum AIC and BIC and the largest log-likelihood is preferred. Based on Table 3, the negative binomial model has the smallest AIC and BIC and maximum log-likelihood, NB model is the most appropriate and preferred model among the two models.

Table 4. Estimated coefficients of NB regression model

Variables	Coef.	Std. Err.	z	P>|z|	[95% CI]	
Average age	1.511936	.3009802	5.02	0.000	.9220257	2.101846
Recovered cases	-.4566332	.1427802	-3.20	0.001	-.7364772	-.1767892
Number of death	.5164175	.190096	2.72	0.007	.1438362	.8889987
Severe cases	1.038589	.1456289	7.13	0.000	.7531619	1.324017
_cons	-6.610632	.3034813	-21.78	0.000	-7.205444	-6.01582
Log(Total tests)	1(offset)					
/lnalpha	-.8297422	.1576706	-5.73	0.000	-1.138771	-.5207136
alpha	.4361617	.0687699			.3202124	.5940964

The results in Table 4 indicated that the average age of patients per day was a positive significant effect on the prevalence of COVID-19 in the Amhara region. The expected number of confirmed cases for females in the average age group (above 30) was 4.5 times more than compared to those in the age group (less than or equal to 30) controlling for other variables in the model.

The finding of this study also revealed that the number of recovered cases had a significant factor in the number of confirmed cases of females. The estimated number of confirmed cases for females with the number of recovered cases (greater than or equal to 20) was decreased by 0.63 times as compared to those with less than 19 number of recovered (reference group) controlling other variables in the model.

According to the findings of this study, the number of death has a significant influence on the number of confirmed cases for females. The expected number of confirmed cases for females in the deaths (greater than or equal to 2 deaths) was 1.64 times more than the expected number of confirmed cases for females in the reference group(less than 2 deaths), while holding all other variables in the model constant.

In this study, severe cases or critical cases have a significant effect on the prevalence of COVID-19 for females. The estimated prevalence of COVID-19 for females in critical cases (greater than 12 critical cases) was 2.8 times more than females who were less than or equal to 12 serious cases.

4 Discussion

The data set was obtained from Amhara Public Health Institute 2020. Out of 5,627 confirmed cases, 1,483 confirmed cases were females and 4,144 confirmed cases were males from 138 daily reports, and from this 96 patients were died.

Based on the Negative Binomial regression model, the estimated number of confirmed cases for females was increased in the average age patients of above 30. As the results revealed, the average age of patients per day was found to be an important predictor for the prevalence of COVID-19 for females in the Amhara region. The main reason for this is the fact that older-aged patients also suffer from other illnesses medically termed as hypertension, HIV/AIDS, sugar diseases, people who have breathing problems, and so on. This result is in line with other studies [12,13,14].

According to the results, the number of the recovered cases was a significant determinant of the prevalence of COVID-19 for females. The estimated prevalence of COVID-19 for females was high for increase the number of severe cases. This result is consistent with others' findings [15].

The number of death per day has a significant influence on the number of confirmed cases for females. The expected number of confirmed cases for females were high for increasing the total number of death. This study is in line with [16,17]. This study revealed that the number of recovered cases had a significant factor in the number of confirmed cases of females. The estimated number of confirmed cases for females with the number of recovered cases was decreased for increasing the number of recovered cases [17].

5 Conclusion

The purpose of this investigation was to identify factors of confirmed cases of COVID-19 for females in the Amhara region**.** NB model is the most appropriate and preferred model among the two models. The study was based on secondary data obtained from Amhara Public Health Institute. Based on this study, the number of recovered cases, severe cases, death, and the average age of patients per day were significant factors for the prevalence of COVID-19 for females in the Amhara region. However, above 30 average age of patients per day, below 19 number of recovered cases, above 12 number of severe cases, and above two number of deaths are optimally high-risk factors of confirmed cases of COVID-19 for females. Therefore, the ministry of health of Ethiopia and local governments should develop effective strategies and interventions to address the prevalence of COVID -19 for female problems. In addition, to enhance and promote the implementation of recommended self-care and home-based isolation practices, the government should give due attention to high-risk prone groups and vulnerable parts of the population and it should be supported with strong clinical services and public health research. Moreover, it is important to consider the number of recovered cases during the interventions. To minimize the prevalence of COVID -19 for females, Amhara public health institute should develop gender-equitable solutions for the pandemic and ensure better targeting of prevention and intervention efforts for all age groups, especially at an older age.

Competing Interests

Author has declared that no competing interests exist.

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